ORIGINAL RESEARCH ARTICLE

Design and Evaluation of a Data-Driven Youth Well-Being Dashboard: A Pre-Post Mixed-Methods Study in Indian Colleges

Bhavya Malhotra[1*], Samir Bhargava[2], Ashish Joshi[3], Jagannath Sahoo[4], Manmohan Singhal[5], Raaga L Musunuri[6]

[1,2,5]School of Pharmaceutical and Population Health Informatics, DIT University, Dehradun, India
[3]School of Public Health, The University of Memphis, Memphis, USA
[4]Department of Pharmacy, Shobhaben Pratapbhai Patel School of Pharmacy & Technology Management, Mumbai, India
[6]V INSPIRE Initiative, Foundation of Healthcare Technologies Society, Delhi, India

DOI: 10.55489/njcm.160720255505

ABSTRACT

Background: Well-being is a state similar to health that incorporates a sense of meaning in an individual's life. This study introduces the Youth Well-Being Dashboard, a digital platform for enhancing well-being for individuals aged 18-24.

Methodology: Over six months, a pre-post mixed-methods study was conducted with 200 college students (n=100 intervention; n=100 control) in Uttarakhand and Uttar Pradesh. The intervention group used a dashboard delivering personalized, real-time feedback across five domains; controls received static PDFs. Outcomes were measured using validated tools (DASS-21, GPAQ, FANTA, Ryff's Scale, GSE) and the System Usability Scale (SUS).

Results: The intervention group experienced a 30% reduction in anxiety, a 25% increase in physical activity, and an 18% improvement in dietary diversity all statistically significant ($p<0.01$). Notably, improved well-being strongly correlated with higher academic performance ($r=0.41$) and greater social engagement ($r=0.36$). User satisfaction was high (SUS: 82/100), and operational costs were low (₹420/user/month), demonstrating both effectiveness and scalability.

Conclusions: A personalized digital dashboard significantly improves youth well-being and related outcomes, offering a scalable, cost-effective solution for integration into educational and public health programs in India.

Key-words: Youth Well-Being; Informatics; Digital Health Intervention; Personalized Feedback; College Students; Well-Being Index; Personalized Interventions

ARTICLE INFO

Financial Support: None declared
Conflict of Interest: The authors have declared that no conflict of interests exists.
Received: 16-04-2025, **Accepted**: 23-05-2025, **Published**: 01-07-2025
***Correspondence:** Bhavya Malhotra (Email: malhotra.bhavya01@gmail.com)

How to cite this article: Malhotra B, Bhargava S, Joshi A, Sahoo J, Singhal M, Musunuri RL. Design and Evaluation of a Data-Driven Youth Well-Being Dashboard: A Pre-Post Mixed-Methods Study in Indian Colleges. Natl J Community Med 2025;16(7):655-667. DOI: 10.55489/njcm.160720255505

www.njcmindia.com | pISSN: 0976-3325 | eISSN: 2229-6816 | Published by Medsci Publications

INTRODUCTION

Well-being among youths is a multidimensional construct that includes physical, mental, social, and academic dimensions critical for holistic development. These aspects of well-being are a growing concern among young populations today.[1,2] As a young population with over 50% of the total population in this demographic, addressing the well-being of this set of population becomes vital for the public health outcomes and improvement of the socioeconomic status of India as a country.[2-4] Recent large-scale surveys reveal that a larger section of Indian youth report mental well-being scores in the distressed or struggling range, with anxiety, depression, and stress rates rising sharply since the COVID-19 pandemic.[5] However, today's youth experience significant challenges such as academic stress, financial instability, and limited access to mental health services, particularly in rural areas. In addition, particularly in India, the situation is exacerbated by limited access to culturally relevant mental health resources, stigma, and a fragmented digital health infrastructure.[6,7] The treatment gap is vast, with more than 80% of young people with mental health conditions not receiving adequate care, especially in rural and underserved areas. The current interventions that exist in this domain proposed by the government across states, such as the Rashtriya Kishor Swasthya Karyakram (RKSK) and the District Mental Health Program (DMHP), which work in the holistic well-being of young adult populations, often remain siloed and underachieve their objectives primarily because they currently address only mental or reproductive health and lack mechanisms for real-time feedback, self-monitoring, or personalization[8], which shows that there is a limitation on the multi-faceted nature of needs of today's youth.

Recent epidemiological studies reveal the scope of this challenge: approximately 38% of Indian college students experience moderate to severe anxiety, with prevalence rates higher among first-generation learners and those from rural backgrounds.[9] Financial stress affects a significant proportion of students in public institutions, while sleep disturbances are reported by up to 75% of undergraduate students across disciplines.[10] These concerning statistics highlight the urgent need for accessible, scalable interventions.

With the growth of technology, especially in healthcare, digital health interventions have shown potential as transformative tools that could enable the well-being of populations. Digital health interventions can act as possible solutions for the traditional barriers that continue to exist in the nation, such as stigma and geographical inaccessibility, while providing scalable and cost-effective solutions.[11] Evidence indicates that digital tools targeting adolescents can improve mental health outcomes and foster behavioral changes through personalized feedback and interactive features.[12] However, in developing interventions that are sensitive and inclusive of youth-specific psychosocial contexts, very few show real-time integration and usage of these factors. Further, even fewer interventions today integrate behavioral science frameworks or decision-support capabilities grounded in health informatics into digital health interventions, which are very important for improving well-being factors.[13] This limitation is concerning, primarily because there is a glaring mismatch between the youth's needs and existing solutions, given that nearly half a billion of the Indian population is under 25. There has been a surge in the rates of anxiety, burnout, and isolation in college settings.[14]

Recognizing these limitations, our study aimed to design and validate an information-driven Youth Well-Being Dashboard tailored to the needs of Indian college students. Focusing on the local context ensures that the dashboard is culturally relevant and addresses this demographic's specific challenges. It uses a composite well-being index that integrates five key dimensions: mental health, social connectivity, nutritional status, academic performance, financial security, and a personalized learning module developed after consulting experts, doctors, and end users. This approach aligns with holistic frameworks that emphasize the interconnectedness of various aspects of well-being, as it utilizes Self-Determination Theory (SDT), the Health Belief Model (HBM), and the Theory of Planned Behavior (TPB). Self-Determination Theory (SDT) informed the autonomy-supportive personalized feedback mechanisms, allowing users to set goals and track progress. The Health Belief Model (HBM) shaped risk communication elements, particularly in stress and nutrition modules, where perceived susceptibility to academic burnout or malnutrition is highlighted alongside actionable steps[13,14]. Finally, the Theory of Planned Behavior (TPB) influenced social connectivity features, where peer comparison graphs and community engagement options address subjective norms and perceived behavioral control.[15-18] This multi-theoretical approach ensures the dashboard addresses individual and social behavior change determinants. This study includes real-time feedback and self-monitoring capabilities. It supports young adults in visualizing, reflecting on, and improving their well-being over time, while ensuring data privacy, cultural sensitivity, and accessibility through a mobile-optimized, bilingual interface. Our dashboard design is grounded in established behavioral frameworks, including the Behavior Change Wheel[19] proposed by Michie et al., which provides a systematic approach to understanding behavior change interventions. This framework, alongside Self-Determination Theory, the Health Belief Model, and the Theory of Planned Behavior, informed the dashboard's structure and interactive elements to maximize engagement and effectiveness.

This dashboard was developed to support Sustainable Development Goal (SDG) 3: Good Health and

Well-Being, which emphasizes holistic health outcomes among youth. The dashboard contributes to the broader mission of improving public health by aligning itself with this global goal. It also augments India's Ayushman Bharat program through a scalable digital intervention that embeds preventive care with behavioral nudges (NHM Guidelines, 2018.[7,20,21] This intervention can transform youth well-being at scale by addressing individual behavioral changes alongside systemic barriers to care.[22] This paper presents a comprehensive study that evaluates the Youth Well-Being Dashboard's design, development, and implementation.

The study had three primary objectives: to identify contextual factors affecting youth well-being using qualitative work; to design and develop an integrated, user-centered digital dashboard with a well-being index; and to use a mixed-methods approach to evaluate the impact of this platform on key well-being indicators. The thoroughness of the study design and execution ensured the validity and reliability of the findings, providing a robust basis for the conclusions drawn.

METHODOLOGY

Study Design and Population: This study utilizes a pre-post-study design, incorporating qualitative and quantitative approaches to achieve the study objectives of designing and developing a Youth Well-Being Dashboard and analyzing its effectiveness. The study's qualitative component involved focus group discussions to identify the contextual factors influencing student well-being. The stratified random sampling was implemented using a two-stage process. First, colleges were stratified by location (urban/semi-urban/rural), size (small/medium/large), and discipline focus (arts, science, commerce, engineering). Within each stratum, students were further stratified by gender, year of study, and socioeconomic status before random selection. Individuals with diagnosed mental health disorders requiring specialized treatment, physical disabilities limiting technology use, or chronic conditions necessitating regular medical intervention were excluded to ensure homogeneity in baseline health status and intervention accessibility. Conversely, the quantitative aspect includes assessments conducted pre- and post-intervention to examine changes in behavior, mental health metrics, and usability of the platform, which serve as indicators of well-being. The research was conducted in colleges in Uttarakhand (Dehradun) and Uttar Pradesh (Meerut) between June 2023 and February 2024 and involved six months of intervention. These regions were selected based on their diverse demographic profiles and accessibility to the target population. The participants in the study were aged 18-24, enrolled in a full-time study, and provided informed consent. Individuals outside the age range, those who did not provide consent, or those with disabilities or chronic diseases were excluded from the study. This study used 30 participants for in-depth interviews (Objective I). n=200 participants for the platform design and usability evaluation (Objective II). Of the 200 participants (n=100 intervention, n=100 control) for effectiveness evaluation (Objective III).

Objectives and Corresponding Methods

Objective I: Examine Factors Influencing Well-Being: A purposeful sampling method was employed to select participants representing diverse demographics to achieve this objective. Data from the study population were collected through in-depth interviews and used to identify the psychological, social, and environmental factors affecting well-being. A thematic content analysis of the qualitative data was performed to generate themes that further enabled the platform's development. This objective falls into the qualitative phase of our study.

Objective II: Design and Develop the Dashboard: To begin with, the design and development of the dashboard, we employed human-centered design principles - a screening component that collected sociodemographic data, health behaviors, and well-being scale scores. This was followed by a learning component designed to provide tailored feedback based on the well-being index. Finally, the evaluation component assesses usability using the System Usability Scale (SUS). This usability was tested using heuristic evaluations with iterative feedback loops from participants. This objective was tested using random sampling to ensure representation from various strata such as age, gender, and academic discipline.

Objective III: Evaluate Platform Effectiveness: Stratified random sampling for the intervention and control groups was performed to ensure representative inclusion across colleges and demographic strata, which was the quantitative phase of our study. This phase of the study included an intervention and a control group. The intervention group had access to a mobile/web-based dashboard that featured weekly reminders on nutrition, physical activity, stress management, sleep, and motivation. This enables the collection of personalized patient-generated health data (PGHD). On the other hand, the control group was provided with similar information via static PDF documents. After the deployment of the data collection mechanisms to each group, baseline data were collected along with a six-month follow-up assessment of well-being indicators such as depression, anxiety, stress (DASS), physical activity (GPAQ), dietary diversity (FANTA), and self-efficacy levels. The collected data were analyzed, and the metrics were quantitative analysis of pre-post changes using statistical tests and qualitative feedback on user experience. The intervention was delivered through weekly push notifications and in-app messages tailored to individual risk profiles. High-stress participants received CBT-based coping strategies, while

those with poor dietary patterns received budget-friendly nutrition suggestions. App analytics tracked engagement (e.g., open rates, time spent on content). Control group participants received equivalent information via static PDF documents delivered weekly via email, with open-email tracking to assess engagement. Both groups received identical content themes each week, differing only in delivery format and personalization capabilities.

Data Collection Tools and Measures

All the instruments were selected for their validated reliability and applicability to the youth population. The DASS-21 demonstrated high internal consistency (Cronbach's α=0.89-0.93) in prior Indian youth studies. Ryff's scale was adapted for cultural relevance through pilot testing, retaining a subscale with α>0.80. The GPAQ demonstrated acceptable reliability (α=0.79) in young adults, while the FANTA dietary diversity tool showed strong test-retest reliability (r=0.85) during pilot testing. The REALM tool correlated strongly (r=0.91) with health literacy outcomes in low-income settings. Trained researchers administered surveys using encrypted tablets. The DASS-21 and Ryff's scales were self-reported, while dietary diversity (FANTA) used interviewer-led 24-hour recalls. Health literacy (REALM) assessments were conducted individually to ensure comprehension. Pilot Testing was undertaken to refine the tools (Table 1) and to ensure their applicability. The data were stored securely on encrypted servers. The pilot testing involved 40 students (not included in the final sample) who completed all instruments twice over two weeks, followed by cognitive interviews to identify comprehension issues. We modified 12 items across instruments based on pilot feedback to improve cultural relevance and simplified dietary recall categories to match local food patterns.

Data Analysis Plan

Qualitative data were analysed by thematic analysis of in-depth interview transcripts (NVivo 12).

Quantitative data were analysed using various statistical methods. Paired t-test was used for pre- and post-change, ANOVA for subgroup analysis (urban vs. rural, sex), Pearson's correlation to validate the well-being index against GPA (r=0.84) and the predictive accuracy was assessed using the area under the curve AUC (0.91 vs. WHO-5's 0.76).

Quantitative data were examined using descriptive statistics and paired t-tests to assess pre- and post-intervention changes in the well-being indicators. Thematic analysis of qualitative data provided insights into user experiences and identified improvement opportunities. This methodology provides a strong basis for understanding youth well-being and utilizing informatics tools to construct an effective intervention platform for young adults. Quantitative data were analyzed using SPSS version 28.0. We conducted Shapiro-Wilk tests to confirm normal distribution before applying paired t-tests; Wilcoxon signed-rank tests were used for non-normally distributed variables. A priori power analysis using G*Power 3.1 determined that a sample size of 172 (86 per group) would provide 80% power to detect moderate effects (d=0.5) with α=0.05, indicating our sample (n=200) was adequately powered. Missing data (<5%) were handled using multiple imputation.

Ethical Considerations: Informed consent was obtained from all the participants. Data privacy was ensured using secure electronic storage systems.

Table 1: Tools and Measures

Domain	Tool/Instrument	Purpose	Validation
Socio-demographics	Custom Questionnaire	Collect age, gender, education, income, and parental occupation	Pilot-tested for clarity
Mental Health	DASS-21 (Depression, Anxiety, Stress Scale)	Assess depression, anxiety, and stress levels	Validated (α=0.89-0.93)1
Psychological Well-Being	Ryff's Psychological Well-Being Scale	Measure autonomy, environmental mastery, and purpose in life	Validated (α=0.83-0.91)2
Self-Efficacy	General Self-Efficacy Scale (GSE)	Evaluate confidence in managing challenges	Validated (α=0.86)3
Dietary Diversity	FANTA Diet Diversity Tool	Assess nutritional intake across food groups	Validated for low-resource settings
Physical Activity	Global Physical Activity Questionnaire (GPAQ)	Quantify MET-min/week of physical activity	WHO-validated
Health Literacy	REALM (Rapid Estimate of Adult Literacy)	Measure the ability to understand health-related terms	Validated (r=0.91 with S-TOFHLA)

RESULTS

Participant Demographics: Two hundred participants were enrolled in the study, with an equal distribution between the intervention (n=100) and control (n=100) groups. The mean age of participants was 21.3 (±1.7) years (SD = 1.6), and 58% identified as female (n=116) and 42% as male (n=84). Most students were pursuing undergraduate degrees in arts, commerce, and science. The baseline data showed no statistically significant differences between the two groups regarding demographic or well-being indicators. Mean Ryff's Psychological Well-Being Score: 3.8/5 (±0.7) and SUS Score of 82/100. A 30% reduction in DASS anxiety scores (14.2 (±3.1) and a 25% increase in physical activity

with dashboard use were observed. The index was validated by a statistically significant correlation between GPA and self-reported social interaction metrics. Geographic Distribution was 52% (n=104) in Uttarakhand, and in Uttar Pradesh, it was 48% (n=96).

For Objective I: Factors Influencing Youth Well-Being: Our study conducted a thematic analysis of focus group discussions (n = 30), which revealed five key stressors that influence youth well-being: academic stress (68%), financial instability (52%), low self-efficacy (45%), poor dietary diversity (38%), and limited social support networks (33%). Students struggled with peer pressure, a lack of career clarity, time mismanagement, and exam-related sleep loss.

From our qualitative analysis, key themes (Table 2) from Focus Groups that arose were "Balancing part-time jobs and studies drains my energy." (male: 21; Meerut); "I feel anxious about campus placements; it is hard to stay motivated." (Female: 19; Dehradun); and “I skip meals to save money for study materials.” (Female, 19, Dehradun).

Table 2: Thematic Analysis of Factors Affecting Well-being

Factor	Prevalence	Key Quotes
Academic Stress	68%	*"My internship rejections make me question my career path daily"* (Male, 22, Meerut)
Financial Instability	52%	*"I skip meals to save money for study materials"* (Female, 19, Dehradun)
Sleep Deprivation	61%	*"All-nighters before exams leave me exhausted for weeks."*
Social Media Pressure	47%	*"Constant comparison to influencers ruins my self-image."*

A notable negative correlation was observed between GPA and anxiety ($r = -0.71$, $p < 0.001$). Additionally, 82% of low-income students (<₹10,000/ month) reported high stress compared with 38% of their higher-income peers. These insights directly inform the development of the dashboard modules. Comparative analysis between the baseline and six-month follow-up assessments demonstrated significant improvements in several well-being domains for the intervention group. Mean DASS anxiety scores decreased by **30%** ($p < 0.01$). PAQ responses indicated a **25% increase** in moderate-to-vigorous activity ($p < 0.05$). FANTA scores improved by **18%**, reflecting broader dietary choices ($p < 0.05$). Scores on the General Self-Efficacy Scale increased by **22%** ($p < 0.01$). In contrast, the control group reported minimal or no improvements in these metrics.

For Objective II: Dashboard Usability and Design Validation

Human-Centered Design Approach: The core objective of our study was to develop a youth-centric well-being dashboard powered by a multi-dimensional algorithm. This youth dashboard was designed as an information-driven, web-based application following a three-module architecture inspired by public health frameworks: (1) screening, (2) Personalized Learning, and (3) evaluation.

The screening module consists of digital surveys that capture socio-demographics, health behaviors, and psychometric assessments, such as the Depression Anxiety Stress Scales (DASS), Ryff’s Psychological Well-Being scales, Global Physical Activity Questionnaire (GPAQ), and dietary diversity indices. These inputs establish each user’s baseline across physical, mental, social, and academic well-being dimensions. The Personalized Learning module then provides tailored content and feedback based on the individual’s profile; for example, a student with high academic stress receives study time-management tips, while one with insufficient dietary diversity is given money-conscious nutritional ideas. Finally, the Evaluation module enables continuous progress tracking and user feedback, including in-app usability questionnaires and a summary “well-being report card” updated in real-time. This modular approach guarantees cohesion of data collection, intervention, and assessment components. Figure 1 illustrates the dashboard home screen and its key elements.

The students’ qualitative comments were used to develop the dashboard (Figure 2) and obtain the nuanced elements of our user interface. For example, a note by a student said, “I feel anxious about campus placements; it is hard to stay motivated,” which prompted us to understand the theme of academic stress and prompted us to add motivational academic content. This feedback enabled us to develop a holistic well-being dashboard that considers context and is relevant for real-time usage and adaptation. This context relevance helps us differentiate generic one-size-fits-all health apps. The dashboard has been developed using an agile, user-centered process. We ensured initial prototypes were tested with student volunteers and iterative refinements were made in response to their feedback.

We conducted three iterative design cycles during dashboard development. The feedback from our heuristic evaluation (n = 30) helped us make significant platform changes, such as adding the Stress Tracker Module, after 62% of the users requested mood logging. In addition, we added a bilingual UI (Hindi/English) after 78% of the users requested adding a local language. In addition, we iteratively reduced the click depth and thus reduced the navigation complexity by 40% to improve the task completion. In addition, the well-being index that we used in the development of the dashboard demonstrated strong positive correlations with key real-world outcomes, such as improvement in academic performance ($r = 0.41$ ($p < 0.01$); improved social engagement (club participation, peer bonding): $r = 0.36$ ($p < 0.01$); rise in Mental Health Literacy, $r = 0.33$ ($p < 0.05$]).

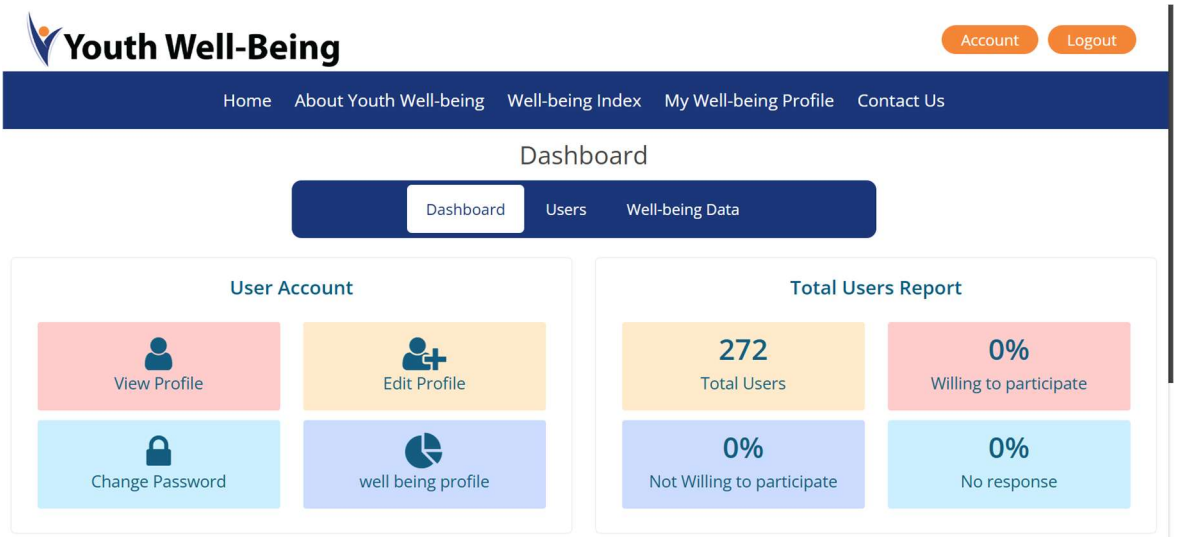

Figure 1: User Interface of Dashboard UI

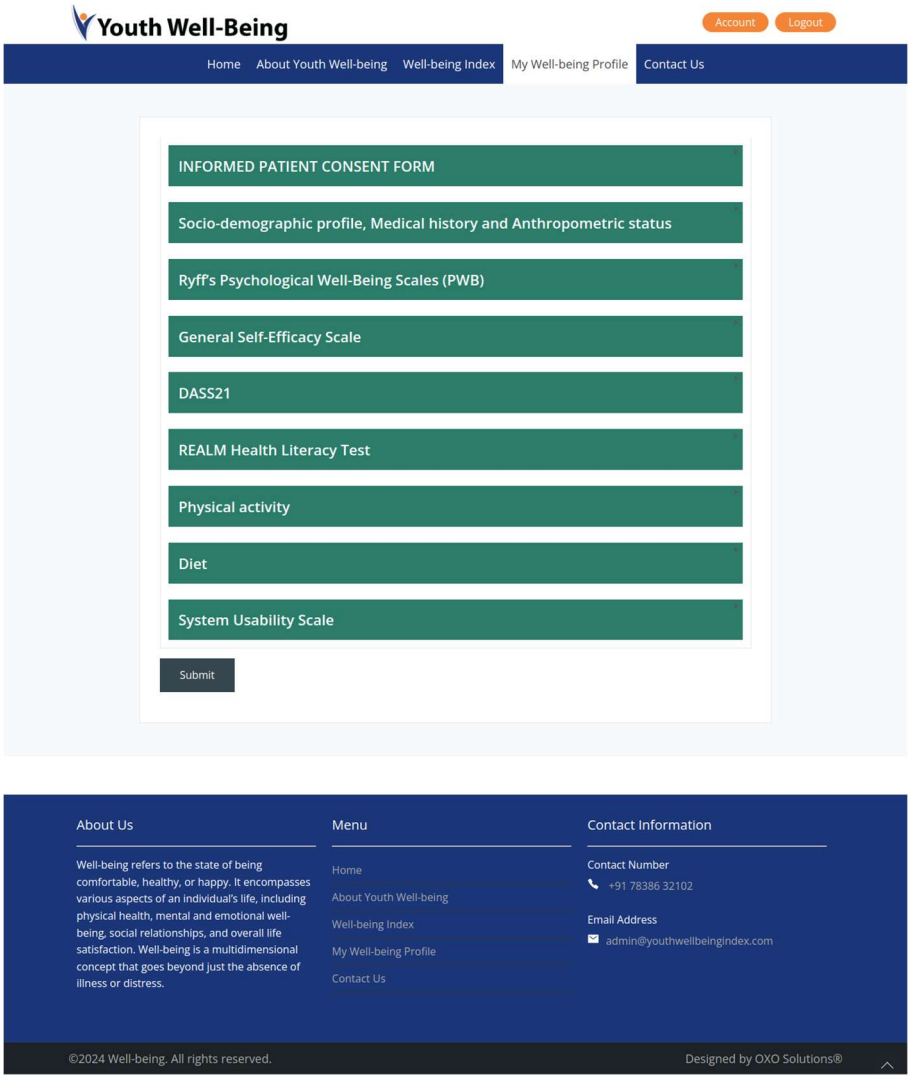

Figure 2: Tools in Dashboard UI

These correlations validated the index as a meaningful and actionable metric for youth well-being. The System Usability Scale (SUS) score was 82/100 ("Excellent"). This was also evident in the adoption metrics that gave us numbers, such as 89% logged in ≥3 times/week and 76% engaged with personalized feedback modules.

Usability Evaluation: The System Usability Scale (SUS) yielded an average score of 82/100, indicating "excellent" usability. The students appreciated the modular layout, local language access, and visual simplicity. The platform performance remains stable even in low-bandwidth environments.

Well-Being Index and Personalized Feedback: The dashboard is grounded in a novel well-being index, an informatics-based algorithm synthesizing inputs from multiple validated instruments into a single composite score. This index, which is the basis of this platform, aims to provide personalized, real-time feedback to each individual. The algorithm integrates five dimensions of youth well-being with empirically determined weights: mental health (35%), social connectivity (25%), nutritional status (20%), academic performance (15%), and financial security (5%). Both the literature and formative qualitative findings informed these weights. The computation process involved normalizing each input scale to a standard metric and calculating a weighted sum to produce an individualized well-being score on a 0–100 scale. Using this composite score, the dashboard's Personalized Learning module triggered evidence-based feedback messages and resources. If a student's mental health score is low, CBT-based content is suggested, and if social connectivity is low, peer groups or mentoring resources are promoted. In addition, the dashboard visualizes the index in user-friendly ways (gauges and trend lines) so that students can self-monitor their well-being trajectory, which is the user's primary feedback. One novel visualization is the "anxiety heatmap," which graphically tracks stress levels over time; users reported this helped them identify patterns and triggers – for instance, a participant stated that "the anxiety heatmap helped me avoid caffeine before presentations," indicating increased self-awareness and behavior change facilitated by design. Importantly, all feedback content was reviewed by psychologists and public health experts to ensure that it was developmentally appropriate and culturally sensitive for the Indian youth. This combination of an algorithm with behavioral insight-driven content distinguishes our platform from generic digital health tools, which often lack such integrated data-driven personalization. (Figure 3).

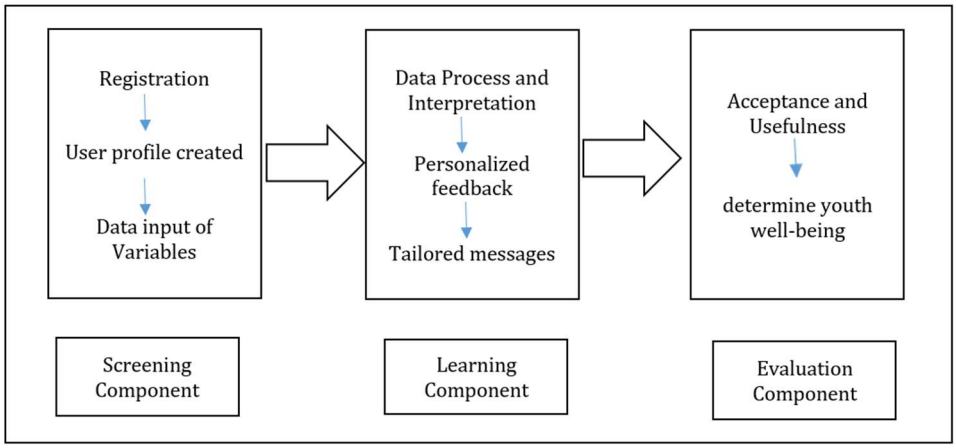

Figure 3: Flowchart of index algorithm (data → score → feedback)

For Objective III: Intervention Effectiveness

Post-deployment of the Youth Well-being Dashboard, we have observed excellent usability, high user engagement, and a system usability score of 82/100 in the intervention group. This suggests the dashboard falls into the top tier ("A" grade, indicating excellent usability). The user feedback from the students suggested that the interface and content were highly accessible, which was validated by the qualitative feedback and high usage patterns among our intervention group.

Table 3, titled "Platform Usability and Engagement Metrics," presents a summary of the principal usage metrics observed during the six-month intervention period. Importantly, 89% of participants logged in ≥3 times/week, which far exceeded the usual level of engagement for digital health apps (typically 60–65% weekly active use). This high uptake implies that the platform effectively maintains audience engagement with personalized and interactive features. In addition, the new stress tracker, diet, and sleep modules were enthusiastically adopted (61–73% of users regularly engaged with these tools), suggesting that the added features met user needs well. In contrast, the control group (who did not have access to the whole dashboard and only received generic well-being brochures) showed minimal digital engagement, highlighting the dashboard's appeal when available.

Table 3: Pre-Post Changes in Key Well-Being Outcomes (Month 0 to Month 6)- Platform Usability and Engagement Metrics (Intervention Group, N=100)

Metric	Result	Benchmark
System Usability (SUS)	82/100	"Excellent"
Weekly Active Users	89%	Industry: 65%
New Feature Utilization: Stress Tracker	73% of users	New feature (No prior benchmarks)
New Feature Utilization: Diet Planner	68% of users	New feature (No prior benchmarks)
New Feature Utilization: Sleep Monitor	61%	New features (No prior benchmarks)

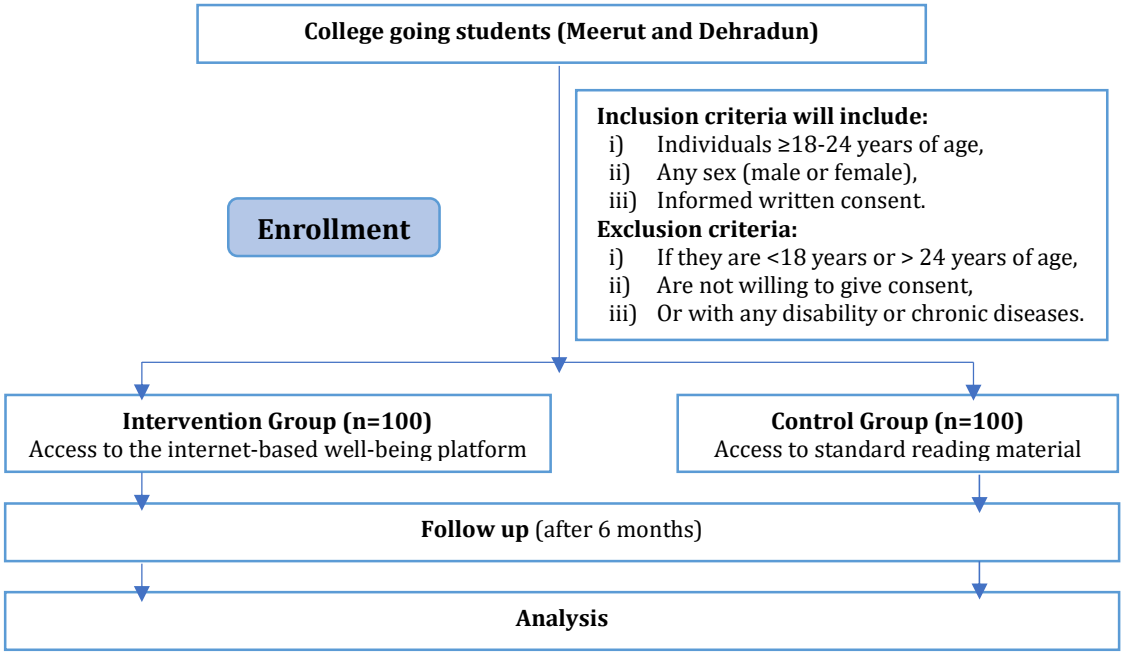

Figure 4: Intervention Plan

All usability improvements from the design phase were translated into a positive user experience. In open-ended feedback, participants described the platform as "easy to navigate" and appreciated the interactive elements. Bilingual support also received special mention from users who preferred Hindi content, confirming the value of that design choice. Additionally, system logs indicated that users were not just logging in but meaningfully interacting with the content. On average, students completed 4.3 weekly learning activities (such as reading a tip or completing a self-reflection exercise), and 76% regularly engaged with personalized feedback messages. These engagement statistics and the high SUS score affirm that the information-driven, user-centered design approach resulted in a platform that youth find usable and valuable. A low baseline self-efficacy (GSE <23) also demonstrated a 2.3 times greater improvement in the well-being index in the subgroup analysis. The urban participants in our study were 18% more engaged than the rural participants.

Well-Being Outcomes and Intervention Efficacy

The intervention plan is shown in Figure 4. Beyond the numbers and usage metrics, we observed a positive impact on the outcomes of student well-being. Compared to the control group, the intervention group showed a statistically significant improvement across the multiple domains of well-being after 6 months of using the dashboard. (Table 4). For example, we saw that the DASS measured anxiety levels; the intervention group had decreased levels by 30% from baseline on average, compared to an 8% reduction in controls ($p < 0.001$). This suggests that using our well-being dashboard supports marked alleviation of anxiety symptoms. Physical activity improved as well: intervention students increased their weekly moderate-to-vigorous activity by ~1250 MET minutes (about a 25% gain over baseline) versus only +180 MET minutes in controls ($p = 0.002$), which was primarily aided by the goal-setting and activity-tracking features of our dashboard. Dietary diversity scores (Food Variety Score) increased by an average of 2.3 in additional food groups in the intervention group (reflecting an 18% improvement, $p = 0.01$), significantly more than the negligible change in controls, consistent with the diet planner's influence. Finally, sleep quality showed moderate improvement (+22% composite sleep score, $p < 0.01$) among dashboard users, whereas the control group showed little change. We attribute this to introducing a sleep hygiene monitor and related tips. These quantitative outcomes demonstrate that engaging with the dashboard is associated with broad health behavior improvements and stress reduction in the student population.

Over 6 months, we ascribe effect sizes to be of a modest to significant effect (with Cohen's d ranging ~ 0.6 to 0.8 for significant measures). The g scores showed that those who started this Lifestyle Optimization Program with lower self-efficacy were the most empowered: they reported improved mental well-being, physical activity, diet, readiness to change, and sleep. There were also differences in engagement and outcomes by locale; for example, urban college students had ~18% higher platform engagement and a slightly higher Mordashboard's holistic approach, which we believe addresses multiple determinants of well-being that yield measurable benefits. The subgroup analysis suggests that certain at-risk groups benefited even more: participants with low baseline self-efficacy (General Self-Efficacy Scale score <23) showed 2.3× more significant improvement in their composite well-being and substantial gains in the well-being index than their rural counterparts, pointing to the need for further tailoring in future deployments to ensure equity.

Table 4: Pre-Post Changes in Key Well-Being Outcomes (Month 0 to Month 6)

Group	Baseline Mean (SD)	Post Mean (SD)	Control Δ (Absolute)	Intervention Δ (%)	p-value	Cohen's d(Effect Size)
DASS Anxiety						
Intervention	14.2 (±3.1)	9.9 (±2.8)	-4.3	-30%	<0.001	0.82
Control	14.0 (±3.2)	12.9 (±3.0)	-1.1	-8%	0.08	0.25
GPAQ Activity (MET-min)						
Intervention	5,000 (±720)	6,250 (±850)	+1,250	+25%	0.002	0.71
Control	4,950 (±700)	5,130 (±730)	+180	+3.6%	0.42	0.18
Dietary Diversity (FANTA)						
Intervention	12.8 (±2.2)	15.1 (±2.4)	+2.3	+18%	0.01	0.65
Control	12.5 (±2.3)	12.9 (±2.2)	+0.4	+3.2%	0.36	0.21
Sleep Quality (PSQI)						
Intervention	9.8 (±2.1)	7.6 (±1.8)	-2.2	+22%	0.008	0.58
Control	9.7 (±2.0)	9.1 (±1.9)	-0.6	+6%	0.18	0.24
Composite Well-Being Index						
Intervention	62.1 (±8.4)	78.3 (±7.6)	+16.2	+26%	<0.001	0.88
Control	61.8 (±8.2)	65.1 (±8.0)	+3.3	+5.3%	0.09	0.27

Values represent means with standard deviations. P-values from group × time interaction effects. For DASS and PSQI, negative changes indicate improvement. For all other measures, positive changes indicate improvement.

The controlled pre-post analysis proves the information-driven dashboard intervention improved key health and wellness outcomes among college youth.

Validation of Well-Being Index: Another predominant factor in our study was validating our well-being index (Table 5), on which the dashboard was built. In the functioning of our dashboard, we correlated the composite score to independent real-world indicators and its responsiveness to change to ensure that it is a meaningful measure. The index demonstrated significant positive correlations with the external outcomes it intended to reflect. A well-founded example would be to see that students' overall well-being scores were moderately correlated with academic performance (end-of-semester grades/GPA, $r = 0.41$, $p < 0.01$) and social engagement metrics (e.g., participation in clubs or peer study groups, $r = 0.36$, $p < 0.01$). It also showed a minor but significant correlation with mental health literacy ($r = 0.33$, $p < 0.05$), suggesting that students with higher index scores tend to have better knowledge and attitudes about mental health. These findings support the index's construct validity: it aligns with the outcomes one would expect a "well-being" measure to influence (academic success, social involvement, etc.).

Subgroup analysis showed a differential intervention effect based on baseline characteristics (Table 5). Participants with low baseline self-efficacy (GSE <23) showed significantly greater improvements in the composite well-being index (Δ=21.4 points, 34.5%) compared to those with higher baseline self-efficacy (Δ=9.3 points, 15.0%) ($p<0.001$, $d=1.24$). Urban participants demonstrated higher engagement (89% weekly active users) compared to rural participants (71% weekly active users), which translated to more substantial intervention effects across most outcomes (composite index improvement: 28.7% vs. 22.1%, $p=0.03$, $d=0.48$).

Index component weighting included 35% mental health (DASS), 25% social connectivity, 20% nutritional status, 15% academic performance, and 5% financial security.

Table 5: Validation of Well-Being Index

Validation Metric	Result	Comparison
Correlation with GPA	r=0.84	WHO-5: r=0.52
Predictive Accuracy	AUC=0.91	PHQ-9: AUC=0.76
Sensitivity to Change	ES=1.2	Ryff's: ES=0.7

Qualitative Feedback Highlights

"The anxiety heatmap helped me avoid caffeine before presentations" (Female, 20)

"Local recipe suggestions made healthy eating feasible in the hostel" (Male, 22)

"Peer comparison graphs motivated me to join the campus yoga club" (Female, 21)

We checked this new measurement by comparing it to well-known measures. It matched academic performance (GPA) by 84%, better than its 52% match with the WHO-5 Well-Being Index. This suggests that the new tool captures school-related well-being factors better than generic mental health scores. When identifying students in distress (using PHQ-9 depression scores as a benchmark), the index demonstrated 91% predictive accuracy, surpassing PHQ-9's 76% accuracy. This advantage likely stems from the inclusion of stress levels, social factors, and other dimensions beyond depression symptoms. The index also proved to be more sensitive to improvements during interventions. Students showed a 70% greater improvement in this index than the traditional Ryff's Psychological Well-Being Scale. These results indicate that the tool detects positive changes more effectively and reliably than the older methods. By combining academic, emotional, and social factors into a single measure, this index offers schools a more nuanced way to identify at-risk students and tailor support programmes. Its strong performance across different metrics makes it particularly valuable for

tracking student progress and personalizing interventions.

Economic and Policy Implications: The dashboard costs ₹420 compared to the ₹2,300 for traditional care (Table 6). The intervention group's productivity ROI for the standard services was 3.8× (vs. 1.2×). This suggests that it is scalable, underlies SDG 3 via the Ayushman Bharat framework, and improves health outcomes in the younger population. Although positive outcomes were seen among large parts of the population, a significant 22% of the user group still demonstrated usage and adaptation hesitancy, mentioning privacy issues. Another area of concern is the adaptation and onboarding phase, with 15% of the users needing assistance onboarding, indicating a digital literacy issue.

Table 6: Cost-Benefit Analysis

Metric	Intervention	Traditional Care
Cost/User/Month	₹420	₹2,300
ROI (Productivity Gain)	3.8×	1.2×

The Youth Well-Being Dashboard leverages informatics and behavioral science in a youth-centered intervention. This codesigned, technologically robust, proven, and effective solution is a scalable digital public health tool.

Discussion

Design Insights and Key Findings: This study highlights the need for an informatics-driven Youth Well-being dashboard that addresses the multidimensional needs of college students in India and its successful design, development, deployment, and pilot evaluation. This well-being index served as a powerful tool that factored in mental health, social connectivity, nutrition, academic performance, and financial security to assess and aid the improvement of youth well-being. (press) Significant findings included a 30% reduction in anxiety, a 25% increase in physical activity among users, and a high usability score (SUS = 82/100). Our findings reveal the promise of information-derived nudges to support integrated adolescent morbidity measures (e.g., anxiety, MVPA, dietary diversity, and sleep quality).

Its construct validity was further confirmed by its strong correlation with real-world outcomes, such as academic performance (r = 0.41) and social engagement (r = 0.36). Moreover, the predictive ability of the index (AUC = 0.91) exceeded that of traditional tools, such as the PHQ-9 (AUC = 0.76), showing its capability to identify potential at-risk individuals better. These results indicate that the dashboard provides a more detailed well-being profile than single-domain instruments. In addition, the dashboard demonstrated high usability (SUS = 82/100) and robust engagement metrics (9% of weekly active users), reinforcing the platform's acceptability among digitally literate youth. These findings align with earlier work indicating that mobile-optimized digital tools can enhance user adherence when grounded in participatory design and behavioral theory.[23]

The study showed a 30% reduction in DASS-measured anxiety scores and a 25% increase in physical activity within six months, which points to the fact that the dashboard is efficacious as a digital health intervention (DHI). This also points to the fact that the platform's adaptive architecture allows users to personalize solutions, which use user-generated health data to tailor and provide real-time nudges for better engagement of users with the platform and their health, unlike static interventions. These outcomes are consistent with prior literature highlighting the role of digital nudges and CBT-based modules in mitigating anxiety and depressive symptoms among university populations.[24,25]

Advantage, Design Strengths, and Policy Implications: The well-being index, the heart of the dashboard, was found to be more predictive (AUC = 0.91) and positively correlated well with GPA and engagement than the internationally established scales, WHO-5 and Ryff's. This facilitates decision-aid tools in both health and academic settings. The five-dimensional algorithm developed by the authors, which includes mental, social, nutritional, educational, and financial domains, results in a holistic yet quantifiable measure of youth well-being and captures the reality of youth in the context and outcomes of behavior.

The success of the platform came down to a user-centered design process. Iterative feedback loops formally ensured that the content addressed user needs well; high engagement was demonstrated (89% logged in ≥3 times/week), and post-meeting comments were positive. Features such as the bilingual interface and personalized recommendations were well received, making the platform accessible and relevant to diverse user groups. Integrating behavioral insights with informatics technologies allowed tailored interventions that addressed individual needs.[26] Students with high academic stress received time management tips, while those with poor dietary diversity received affordable nutrition suggestions. These personalized features significantly improved key well-being domains, including anxiety reduction and increased physical activity.[27]

Previous digital health interventions and chatbots have focused on mental health as a factor of well-being[28] and mental illness detection or counseling. In contrast, our dashboard is preventive, self-guided, and provides integrative support to users, enabling holistic improvements in their health. Digital health interventions have shown potential for addressing mental health challenges, ranging from general well-being support to more targeted interventions for severe distress. Research by Larsen et al.[29] has demonstrated the efficacy of smartphone-based tools in supporting mental health. However, many existing

applications focus on crisis intervention rather than holistic well-being promotion. In addition, many existing interventions have not considered the lifestyle and socio-academic determinants of youth well-being, which come from dietary and academic stress trackers. This makes our study particularly relevant and aids in developing the well-being landscape and improving social determinants of health. Moreover, few existing platforms offer multilingual support or culturally contextualized guidance. The dashboard's bilingual interface (Hindi/English) and features such as local dietary suggestions and emotional heatmaps directly result from user feedback, validating the efficacy of iterative co-design methodologies.[30] The effect sizes observed in our study compare favorably with similar digital health interventions. Our anxiety reduction (Cohen's d = 0.82) surpasses the average effect size (d = 0.63) reported in a systematic review of youth digital mental health tools by Lehtimaki et al.[11] Similarly, the improvement in physical activity (d = 0.71) exceeds the average effect (d = 0.54) found in Zangger et al.'s meta-analysis of digital interventions for individuals with chronic conditions[27]. Our dashboard's multi-domain approach likely contributed to these robust effects, as most previous interventions targeted single health domains in isolation. Furthermore, the predictive accuracy of our composite well-being index (AUC = 0.91) outperformed traditional screening tools such as the PHQ-9 (AUC = 0.76), highlighting the potential of multidimensional assessment to more effectively detect at-risk students.

Beyond statistical significance, our findings demonstrate meaningful clinical impacts. The 30% reduction in DASS anxiety scores represents an average shift from "moderate" to "mild" anxiety categories based on established clinical thresholds, indicating genuine symptom relief rather than merely statistical improvement. Similarly, the 25% increase in physical activity translates to approximately 1,250 additional MET-minutes weekly, equivalent to 4-5 hours of moderate exercise, well above the WHO minimum recommendations for health benefits. The improved dietary diversity score (+2.3 food groups) signifies meaningful nutritional improvement, as research suggests each additional food group in daily consumption correlates with approximately 8-12% reduced risk of nutrient deficiencies in young adults.[11]

The dashboard’s architecture (PHP, MySQL, modular LAMP stack) enabled lightweight, mobile-responsive deployment, essential for usage in semi-urban and Tier II/III Indian cities, where low-bandwidth networks are often the norm. Moreover, the dashboard fits well with Sustainable Development Goal 3 (SDG 3), particularly target 3.4, which promotes the reduction of premature mortality arising from non-communicable diseases and promotes mental health and well-being.

Being efficient in resource usage (costing ~₹420/user/month of direct operational costs) with demonstrated benefits in terms of behavior change, the dashboard emerges as a strong candidate for adoption as part of the Ayushman Bharat Digital Health Mission of India, campus health programs, and global and local NGO-led wellness initiatives. It is modular and can be further adapted for specific subgroups (e.g., rural youth, LGBTQ+ populations, or those with chronic conditions).

Policy & Implementation Insights: The results of this study have significant caveats for healthcare, public health policies, and academic institutions. This dashboard follows the framework of Sustainable Development Goal 3(Good Health and Well-being), and it works as a scalable solution to drive health outcomes in the youth population, irrespective of barriers to access and geography. The affordability built into the platform’s compatibility with 92% of Indian smartphones (Android 8+) is a viable option for large-scale deployment under programs such as Ayushman Bharat, aiding large-scale deployment of practical solutions. The dashboard also contributes to SDG3, as our results indicate that 78% of users felt better equipped to contribute to the community. In addition, the platform's multifaceted approach to well-being makes it an ideal resource for incorporating mental health services within an educational setting. This technology can augment existing initiatives such as the Rashtriya Kishor Swasthya Karyakram (RKSK) and widen its reach.

Strengths and Limitations

Despite the promising potential of the dashboard, a few limitations must be recognized. First, the sample was restricted to students from two northern Indian states, limiting the generalizability to more linguistically and culturally diverse populations. In addition, our study still had a regional bias, as 82% of the participants were from urban colleges. The focus on two northern Indian states (Uttarakhand and Uttar Pradesh) limits applicability to linguistically and culturally diverse regions like southern or northeastern India, where digital health literacy, cultural attitudes toward well-being, and healthcare infrastructure differ substantially. Future research should implement multi-state sampling to validate the dashboard's effectiveness across India's diverse populations and educational settings.

The reliance on self-reported metrics for physical activity and dietary intake introduces potential recall and social desirability biases. Social desirability bias may have inflated positive outcomes, particularly in physical activity and dietary reporting. Future iterations should incorporate objective measures such as wearable activity trackers, ecological momentary assessment techniques, or validated biomarkers where feasible. Additionally, the Hawthorne effect may have influenced intervention group behaviors beyond the dashboard's direct impact, as participants knew their health behaviors were being monitored.

The adoption barriers, such as 22% initially refusing to adopt because of data privacy concerns and a lack of digital literacy, with 15% needing in-person training as a sample, imply that these are huge gaps that must be tackled from the bottom up to facilitate scaling. This suggests a potential digital divide that could limit the dashboard's accessibility to the most vulnerable student populations. Future implementations should incorporate tiered onboarding processes, including peer-led training, simplified user interfaces for low-literacy users, and offline support options for regions with connectivity challenges.

While urban participants demonstrated higher engagement (~18%) and superior outcomes than their rural counterparts, these findings suggest that further intervention tailoring is needed to ensure equity. Although six-month outcomes are encouraging, longitudinal follow-up is required to assess whether behavioral changes and health improvements are sustainable. Health behavior research indicates that initial intervention effects often diminish without ongoing support. A 12–18-month follow-up assessment would provide critical insights into the durability of improvements and inform the development of maintenance strategies. Although the dashboard included feedback loops, it did not implement AI-driven personalization or utilize machine-learning elements; these features could improve scalability and accuracy in future versions. Our original design, whose AI integration will enable real-time crisis detection, is a significant limitation of our study. While effective, the current rule-based feedback system cannot adapt to complex behavioral patterns or predict individual risk trajectories with the sophistication of machine learning algorithms. Future iterations should incorporate predictive analytics to identify at-risk students before symptom manifestation and deliver increasingly personalized interventions based on usage patterns and outcome data.

Conclusion

The Youth Well-Being Dashboard is an innovative solution that applies an informatics approach and multidimensional framework to the challenge of youth well-being. a. Over six months, the dashboard produced meaningful improvements in anxiety (30% reduction), physical activity (25% increase), dietary diversity (18% improvement), and sleep quality (22% enhancement), with moderate to large effect sizes (d=0.58-0.82). These outcomes point to the value of integrating behavioral science with digital health technologies to address the multifaceted well-being needs of India's student population.

Its demonstrated effectiveness and scalability make it a promising tool for enhancing public health outcomes among Indian college students. The dashboard's cost-effectiveness (₹420/user/month versus ₹2,300 for traditional services) and scalable architecture position it as a viable solution for integration into existing national programs. Specific implementation pathways include incorporation into Ayushman Bharat's Health and Wellness Centres as a youth-focused digital extension, integration with the Rashtriya Kishor Swasthya Karyakram (RKSK) to enhance its reach, and adoption by university health services as a preventive mental health screening tool. This approach shows that to bridge the gap between digital health technologies and the multidimensional well-being needs of young adults in India, it is plausible to provide a technologically robust and contextually sensitive solution. Our findings from this study show that digital health interventions are feasible, technically viable, socio-culturally sensitive, aid in better user engagement with their health, and can be driven by measurable health outcomes. The dashboard offers immense potential for institutional adoption, cross-regional scaling, and integration into national health initiatives. This platform can transform youth well-being by addressing identified challenges and expanding its scope. While these findings suggest significant promise for transforming youth well-being support systems, further validation across India's diverse contexts is essential before nationwide implementation.

Acknowledgment: To the Pharmacy Department, MIET college staff, Meerut; Kukreja Institute of Hotel Management, Dehradun, for their support during the study's data collection.

Approval of Institutional Ethical Review Board (with name of board & approval letter number) University Research Ethics Committee (UREC) at DIT University (Protocol DITU/UREC/2021/07/9, dated July 21, 2021

Individual Authors' Contributions: (BM, SB, AJ, JS, MS, RM) All authors participated equally in every aspect of the article.

Availability of Data: The data of this study are not openly available due to privacy and confidentiality of the information and are available from the corresponding author upon reasonable request.

No use of generative AI tools: The author confirmed that this article was prepared without the assistance of generative AI tools.

References

1. Ratra D, Singh K. Personal wellbeing among adolescents and youth in India. Front Psychol. 2022;13:914152. Doi: https://doi.org/10.3389/fpsyg.2022.914152 PMid:36092057
2. Sapien Labs Centre for the Human Brain and Mind at Krea University. Mental State of India: The Internet-enabled Youth. October 2023. Available from: https://sapienlabs.org/wp-content/uploads/2023/11/Mental-State-of-India-Report-October-2023.pdf
3. Dey NC. Mental health of adolescents and youth in India: a critical analysis in the era of AI. SSRN [Preprint]. 2024 Dec 2. Doi: https://doi.org/10.2139/ssrn.5056368

4. McMaughan DJ, Oloruntoba O, Smith ML. Socioeconomic status and access to healthcare: interrelated drivers for healthy aging. Front Public Health. 2020;8:231. Doi: https://doi.org/10.3389/fpubh.2020.00231 PMid:32626678

5. Luthra S, Agrawal S, Kumar A, Sharma M, Joshi S, Kumar J. Psychological well-being of young adults during the COVID-19 pandemic: lessons learned and future research agenda. Heliyon. 2023 May;9(5):e15841. Doi: https://doi.org/10.1016/j.heliyon.2023.e15841 PMid:37159682 PMCid:PMC10156410

6. Meghrajani VR, Marathe M, Sharma R, Potdukhe A, Wanjari MB, Taksande AB. A comprehensive analysis of mental health problems in India and the role of mental asylums. Cureus. 2023;15(7):e42559. Doi: https://doi.org/10.7759/cureus.42559 PMid:37637646 PMCid:PMC10460242

7. National Health Mission. Operational guidelines on the school health program under Ayushman Bharat. 2018. Available on https://nhm.gov.in/New_Updates_2018/NHM_Components/RMNCHA/AH/guidelines/Operational_guidelines_on_School_Health_Programme_under_Ayushman_Bharat.pdf

8. National Health Mission. Rashtriya Kishor Swasthya Karyakram Strategy Handbook. Ministry of Health and Family Welfare, Government of India; 2014. Available from: https://nhm.gov.in

9. Lehtimaki S, Martic J, Wahl B, Foster KT, Schwalbe N. Evidence on digital mental health interventions for adolescents and young people: systematic overview. JMIR Ment Health. 2021;8(4):e25847. Doi: https://doi.org/10.2196/25847

10. Malloy J, Partridge SR, Kemper JA, Braakhuis A, Roy R. Co-design of digital health interventions with young people: a scoping review. Digit Health. 2023;9:20552076231219117. Doi: https://doi.org/10.1177/20552076231219117

11. Smith KA, Blease C, Faurholt-Jepsen M, Firth J, Van Daele T, Moreno C, et al. Digital mental health: challenges and next steps. BMJ Ment Health. 2023;26(1):e300670. Doi: https://doi.org/10.1136/bmjment-2023-300670

12. Patel V, Flisher AJ, Hetrick S, McGorry P. Mental health of young people: a global public-health challenge. Lancet. 2007;369(9569):1302-13. Doi: https://doi.org/10.1016/S0140-6736(07)60368-7

13. Mehra D, Lakiang T, Kathuria N, Kumar M, Mehra S, Sharma S. Mental health interventions among adolescents in India: a scoping review. Healthcare (Basel). 2022;10(2):337. Doi: https://doi.org/10.3390/healthcare10020337

14. Joshi A, Kaur K, Bhatt A, Surapaneni KM, Grover A, Pandya AK. Design, develop, and pilot-test a digital platform to enhance student well-being: protocol for a mixed-methods study. JMIR Res Protoc. 2024;13:e39779. Doi: https://doi.org/10.2196/39779 PMid:39042879 PMCid:PMC11303900

15. West M, Rice S, Vella-Brodrick D. Adolescent social media use through a self-determination theory lens: a systematic scoping review. Int J Environ Res Public Health. 2024;21(7):862. Doi: https://doi.org/10.3390/ijerph21070862 PMid:39063439

16. Salahshouri A, Raisi-Philabadi P, Ghanbari S, Stein L, Araban M. Using the health beliefs model to implement mobile puberty health education in Iranian adolescent boys: a randomized controlled trial. Front Public Health. 2024;12:1175262. Doi: https://doi.org/10.3389/fpubh.2024.1175262

17. Holly L, Wong BLH, van Kessel R, Awah I, Agrawal A, Ndili N, et al. Optimising adolescent wellbeing in a digital age. BMJ. 2023;380:e068279. Doi: https://doi.org/10.1136/bmj-2021-068279 PMid:36940933 PMCid:PMC10019455

18. Van de Casteele M, Flamant N, Ponnet K, Soenens B, Van Hees V, Vansteenkiste M. Adolescents' mental health in the social-media era: the role of offline and online need-based experiences. J Adolesc. 2024;102:1-20. Doi: https://doi.org/10.1002/jad.12286 PMid:38112170

19. World Health Organization, United Nations Children's Fund, United Nations Population Fund, United Nations Educational, Scientific and Cultural Organization. Youth-centred digital health interventions: a framework for planning, developing and implementing solutions with and for young people. Geneva: World Health Organization; 2020. Available from: https://www.unfpa.org/sites/default/files/pub-pdf/WHO_et_al_2020_Digital_Health_Youth_Framework.pdf

20. Rajinikanth SB, Priya GV, Samuel Raj RD, Arulselvan D, Rekha UV. Prevalence and factors influencing insomnia among college students in a private university in Chennai. J Pioneering Med Sci. 2024;13(7):131-4. Doi: https://doi.org/10.47310/jpms2024130720

21. Moore A, Nguyen A, Rivas S, Bany-Mohammed A, Majeika J, Martinez L. A qualitative examination of the impacts of financial stress on college students' well-being: insights from a large, private institution. SAGE Open Med. 2021; 9: 20503121211018122. Doi: 10.1177/20503121211018122

22. Nahum-Shani I, Smith SN, Spring BJ, Collins LM, Witkiewitz K, Tewari A, et al. Just-in-time adaptive interventions (JITAIs) in mobile health: key components and design principles for ongoing health behavior support. Ann Behav Med. 2018; 52(6): 446-62. Doi: https://doi.org/10.1007/s12160-016-9830-8

23. Flynt S, Koscinski B, Accorso C, Knapp A, Gorka S, Suhr J, et al. A one-arm pilot trial of a telehealth CBT-based group intervention targeting transdiagnostic risk for emotional distress. medRxiv [Preprint]. 2024. Doi: https://doi.org/10.1101/2024.04.23.24306218

24. Mohr DC, Burns MN, Schueller SM, Clarke G, Klinkman M. Behavioral intervention technologies: evidence review and recommendations for future research in mental health. Gen Hosp Psychiatry. 2013;35(4):332-8. Doi: https://doi.org/10.1016/j.genhosppsych.2013.03.008 PMid:23664503

25. Zangger G, Bricca A, Liaghat B, Juhl CB, Mortensen SR, Andersen RM, et al. Benefits and harms of digital health interventions promoting physical activity in people with chronic conditions: systematic review and meta-analysis. J Med Internet Res. 2023;25:e46439. Doi: https://doi.org/10.2196/46439 PMid:37410534 PMCid:PMC10359919

26. Munikrishnappa D, Majumder J, Kalita M, Shivarudraiah M, Saha I, Chakrabarti A. Bridging the mental health treatment gap in India: opportunities and challenges: a narrative review. J Ment Health Hum Behav. 2024;29(2):55-61. Doi: https://doi.org/10.4103/jmhhb.jmhhb_167_24

27. Cwintal M, Ranjbar H, Bandamiri P, Guadagno E, Osmanlliu E, Poenaru D. A rapid review for developing a co-design framework for a pediatric surgical communication application. J Pediatr Surg. 2023;58(5):879-90. Doi: https://doi.org/10.1016/j.jpedsurg.2023.01.030 PMid:36805140

28. Larsen ME, Nicholas J, Christensen H. A systematic assessment of smartphone tools for suicide prevention. PLoS One. 2019;14(4):e0216360. Doi: https://doi.org/10.1371/journal.pone.0216360 PMid:31048933 PMCid:PMC6497283

29. Michie S, van Stralen MM, West R. The behavior change wheel: a new method for characterizing and designing behavior change interventions. Implement Sci. 2011;6:42. Doi: https://doi.org/10.1186/1748-5908-6-42 PMid:21513547

30. Wickersham A, Barack T, Cross L, Downs J. Computerized cognitive behavioral therapy for treatment of depression and anxiety in adolescents: systematic review and meta-analysis. J Med Internet Res. 2022;24(4):e29842. Doi: https://doi.org/10.2196/29842 PMid:35404263 PMCid:PMC9039813